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High Plains Herald

National Weather Service
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The National Weather Service provides weather forecasts and warnings for the protection of life and property and the enhancement of the national economy.

Inside this Issue:

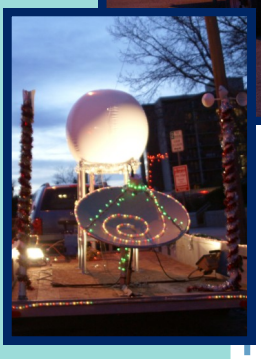
Staff Enhances Third Grade Atmospheric Science Curriculum

By S. Carpenter

On December 8th, 2010, third graders at Pioneer Park Elementary School were presented several experiments exhibiting concepts related to the science of the atmosphere curriculum they are studying during November, December and January. Five staff members from the National Weather Service Forecast Office in Cheyenne participated in the presentation. Science Operations Officer, Rob Cox, prepared four experiments to display the concepts of atmospheric pressure and the Bernoulli Principle. The model tornado and Van de Graff generator were also presented to describe severe thunderstorms and lightning. Staff members that joined Rob for the event were Scott Carpenter, Richard Emanuel, Mike Jamski and Debbie Winston. This event was a test to see if the experiments were suitable learning aids for the specific topics defined by the school's curriculum. The third grade teachers at Pioneer Park expressed their appreciation for how the meteorologists made the experiments fascinating, and then took the time to explain how the experiments related to the specific concepts the students were studying. Based on the success of this test, the NWS staff hopes to send a few staff members to numerous other schools across the forecast area to use these and other experiments to enhance the learning experience of any age group focusing on the science of the atmosphere. Schools or extracurricular groups interested in having NWS personnel present can arrange an event by contacting the NWS Forecast Office in Cheyenne at 307-772-2468.

Rob Cox and Rich Emanuel performing experiments.

The Van de Graff Generator is fun!



WFO Cheyenne float in the 20th Annual Cheyenne Christmas Parade. The float was built by staff members and their families, and featured a mock KCYS WSR-88D radar, anemometer, wind vane, satellite dish, the "Wyoming Windsock," "and rain gauge.

WFO Cheyenne on Parade

By R. Mazur

Members of the WFO Cheyenne staff and their families participated in the 20th Annual Cheyenne Christmas Parade held on November 27, 2010. The theme was "20 years of Magic and Music" and featured over 100 floats from organizations across the city. This was the second year we entered in the parade, and participants utilized the opportunity to reach out to the community to increase awareness about our products and services. The float featured a revamped mock-KCYS WSR-88D radar, satellite dish, wind sensors, rain gauge, and the famed "Wyoming Windsock" chain, which were all dressed in over 1000 lights. Staff members and their families handed out information cards with weather awareness and safety tips to the parade's spectators, all the while sharing the joy of the Christmas season.

Snotel: Snow Measuring

By M. Weiland

You may have wondered how snow depth and amount of water observed in the snow are determined in remote mountain areas. This is an important question as the snowpack in our mountains basically determines how much water will be available that summer and fall for irrigation, human consumption and recreation. In dry snow seasons, the reservoirs have less water available to store which impacts future use. Likewise, in wet snow seasons, there will be more water available later that year after snowmelt. There are two main ways that the snowpack and amount of water in that snowpack are determined. In southeast Wyoming, there are about 15 SNOTEL sites. These are automated sites owned and maintained by the National Resources Conservation Service (NRCS). Every 5 minutes, information from these sites is sent to a satellite and back to the users in the area. Most of the sites measure snow depth, precipitation, snow water equivalent (how much water is in the snow) as well as temperature. This information has been recorded for many years and so current data can be compared with normal values. Each SNOTEL site is placed near the start of rivers such as the Laramie, Encampment and North Platte.

In addition to the SNOTEL sites, there are a number of snow course sites in our mountains. These are certain places where scientists measure the snow depth and snow water equivalent themselves. This is done at various times throughout the winter. The information from those two sources is then used to determine how much water is available, whether that is more or less than normal and finally, how much water will be available to area rivers, streams and reservoirs for the summer after snowmelt.

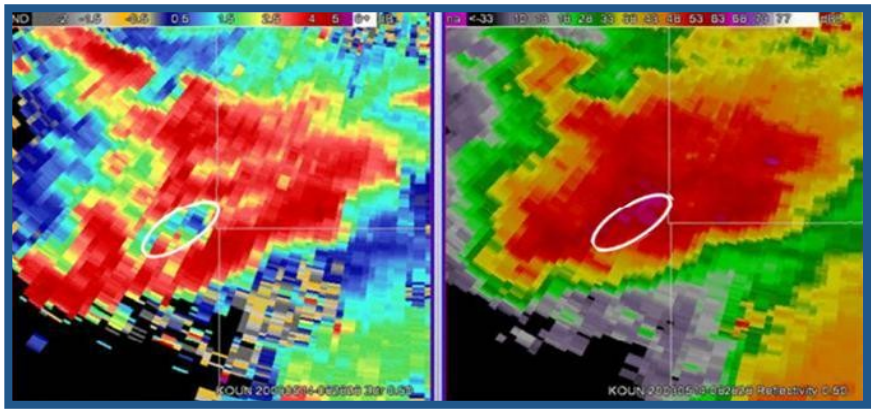
Doppler Radar and Dual Polarization

By M. Jamski

Doppler radars (WSR-88D) transmit radio waves, or pulses, in a single, horizontal orientation, or polarization. The pulses bounce off meteorological (clouds, snow, ice pellets, hail and rain drops) and non-meteorological (birds, insects, ground clutter) particles in the atmosphere, and are reflected back to and received by the radar antenna. After computer processing, the returned signals are converted into data describing the horizontal properties of the particles, including their dimensions, direction and speed of movement. For example, the distance from the radar to the target is calculated from the amount of time that lapses from the initiation of the pulse, to the detection of the return signal. The radar reflectivity you see on a radar image is actually the "reflected" pulse energy received by the radar.

Dual-polarization radars transmit and receive both horizontally and vertically oriented pulses. This allows the radar to collect data displaying the horizontal and vertical properties of the targets. Dual-polarization will result in significant improvements in the estimation of precipitation rates, the ability to discriminate different precipitation types (rain vs. hail, mixed precipitation types in winter storms), and the identification of non-meteorological returns. For aviation concerns, forecasters will be able to better discern areas of icing and other hazards such as birds. All these improvements will aid forecasters in the warning decision process, helping the public make better decisions about their safety and protecting their property.

Between January 2011 and March 2013, WSR-88D radars will be upgraded with the new dual-polarization technology. The radar products currently available to users are reflectivity, mean radial velocity, and spectrum width. Three new products available after the upgrade will be differential reflectivity, correlation coefficient, and specific differential phase. Below is an example of differential reflectivity on the left, versus reflectivity on the right. The area circled on both images is a hail core in a thunderstorm, demonstrating how differential reflectivity can better discriminate hail from heavy rainfall. Another new product, quantitative precipitation estimation, will estimate the instantaneous rainfall rate. Currently, only 1-hour radar-based rainfall rate estimations are available.



". . . will result in significant improvements in the estimation of precipitation . . ."

Just For Fun

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Advisory
Blizzard
Dense Fog
Drift
Drizzle
Flurries
Freezing
Frost
Ice Storm
Sleet
Visibility
Warning
Watch
Whiteout
Wind chill

Answer key is on the last page.

Measuring Performance in the NWS

By M. Jamski

The National Weather Service (NWS) executes a national verification program that provides feedback to forecasters and managers. This feedback is used to improve the quality of forecasts and services. The data from the program provide long-term trends in forecast accuracy and assist managers in establishing baselines of forecast accuracy. From these baselines, improvements in forecast accuracy resulting from scientific advances and new technologies are measured. The program also provides information on the quality of forecasts to NWS customers. The NWS is monitored for its performance via national GPRA (Government Performance and Results Act) goals each fiscal year.

Verification scores are applied at the local, regional, and national levels. In general terms, the scores are measures of accuracy and skill. Accuracy is a measure of how much a forecast agrees with the event or predicted element, i.e., wind, temperature, probability of precipitation. The smaller the difference between the forecast and the observation, the greater the accuracy. Skill is a measure of the improvement of a forecast over an established standard. Examples of standards often used for comparison include the climatological frequency, persistence, or forecasts made by model output statistics (MOS). The greater the improvement, the greater the skill.

The most frequently computed scores for events are: probability of detection (POD), false alarm ratio (FAR), critical success index (CSI), and lead time. POD is the fraction of actual events correctly forecast or warned. The more often an event is correctly forecast or warned, the better the score. FAR is the fraction of all events incorrectly forecast or warned. The more often an event is forecast or warned and does not occur, the worse the score. CSI is the ratio of correct forecasts to the number of events plus the number of incorrect forecasts. The best possible score is 1, the worst is 0. Lead time for events is calculated by subtracting the time of warning issuance from the time when an event was first reported ..

". . . verification scores are applied at the local, regional, and national levels . . ."

Please let us know what you think. We welcome your comments and suggestions
Send us an email at cys.info@noaa.gov

Why Talk About Winter Weather?

By J. Griffith

Winter storms may not be as dramatic as the tornadoes and flash floods of the summer months but they can be just as deadly. Each year, dozens of Americans die due to exposure to cold. Add to that number, vehicle accidents and fatalities, fires due to dangerous use of heaters and other winter weather fatalities and you have a significant threat.

Threats, such as hypothermia and frostbite, can lead to loss of fingers and toes or cause permanent kidney, pancreas and liver injury and even death. You must prepare properly to avoid these extreme dangers. You also need to know what to do if you see symptoms of these threats.

A major winter storm can last for several days and be accompanied by high winds, freezing rain or sleet, heavy snowfall and cold temperatures. People can be trapped at home or in a car, without utilities or other assistance. Attempting to walk for help in a winter storm can be a deadly decision. The aftermath of a winter storm can have an impact on a community or region for days, weeks or even months. The cost of snow removal, repairing damages and the loss of business can have severe economic impacts on cities and towns.

Winter Weather Terms

The following are National Weather Service definitions of some winter weather terms.

Blizzard: Winds of 35 mph or more with snow and blowing snow reducing visibility to less than ¼ mile for at least 3 hours.

Blowing snow: Wind-driven snow that reduces visibility. Blowing snow may be falling snow and/or snow on the ground picked up by the wind.

Snow squalls: Brief, intense snow showers accompanied by strong, gusty winds. Accumulations may be significant.

Snow Showers: Snow falling at varying intensities for brief periods of time. Some accumulation is possible.

Snow flurries: Light snow falling for short durations with little or no accumulation.

Aviation Forecasting Challenges

By G. Claycomb

Elements of the Terminal Aerodrome Forecast (TAF) are very important to pilots and significantly affect their flight planning. Forecasters at the Cheyenne Weather Office are keenly aware of these sensitivities and strive to accurately forecast these thresholds. Depending on how low the cloud ceilings and/or visibilities are forecast in the TAF, determines whether a pilot can file a flight plan to that particular airport. Factors such as the experience/rating the pilot has and what type of instrumentation is included in the aircraft are very important in flight planning. A pilot must use instruments in the aircraft to land or takeoff when the cloud ceiling is forecast to be less than 1000 feet or the visibility is forecast to be less than 3 miles. Other important forecast thresholds in the TAF include cloud ceilings of less than 2000 feet and/or visibility less than 3 miles. This requires the pilot to file for an alternate airport and carry extra fuel to make it to that alternate airport in case he/she needs to divert. This forecast also increases the amount of space required between aircraft that are approaching an airport, reducing airport arrival rates. A forecast of a ceiling less than 800 feet and/or visibility less than 2 miles prohibits a pilot from using that airport as an alternate if it doesn't have precision approach equipment. A forecast ceiling of less than 600 feet and/or 2 miles means the pilot can't use the airport as an alternate at all. Finally, a forecast ceiling of less than 200 feet and/or visibility of less than ½ mile usually shuts down an airport in most cases as this is the field minimum for most airports.

History of Weather Observations in Cheyenne

By D. Winston

On February 9, 1870 President Ulysses Grant signed into law a bill directing the Secretary of War to take meteorological observations and give warnings of approaching storms. It had been decided that the military was the most reasonable source to compile and distribute weather information. The new duties were assigned to the Army Signal Corps.

On November 1, 1870 the Army Signal Corps reported weather conditions from 25 reporting stations, including Cheyenne, in the then, Wyoming Territory. Observations were made three times daily and transmitted to the Office of the Chief Signal Officer in Washington, D. C. via telegraph.

The first observer in Cheyenne was Asa C. Dobbins and the office was opened on the second floor of a building on 16th Street between Capitol and Carey Avenues (previously Hill and Ferguson Streets). The roof of the building was flat, which was perfect for the wind vane and anemometer. Sgt. Dobbins also used a thermometer which was located 17 feet above the ground and a rain gauge that was 10 feet off the ground.

Sgt. Dobbins was a dedicated man. His observation records are still on file in the National Weather Service Office today. Asa and his successor's Daily Journals are quite interesting. Their remarks show similarities to the forecasting terminology developed decades later. Judging from his journal entries, he must have dreamed of improving forecasting techniques providing a greater service to the American public.

The first storm warning was issued at 12:00 PM on November 8, 1870. *"High wind all day yesterday at Cheyenne and Omaha; a very high wind this morning at Omaha; barometer falling with high winds at Chicago and Milwaukee today; barometer falling and thermometer rising at Chicago, Detroit, Toledo, Cleveland, Buffalo and Rochester; high winds probable along the Lakes."*

". . . 1870 the Army Signal Corp reported weather conditions grom 25 reporting stations including Cheyenne. . ."

Happy New Year!

Mountain Snowpack

By M. Weiland

The winter snowfall over the mountains is the source for much of our water throughout the year. We rely on that water for our homes, agricultural, industry and recreation. The snow typically melts in the mountains from late April to early June, with the lower elevations melting earlier than the higher elevations. Some of the snowmelt is captured in various reservoirs for use later in the year. This is especially the case along the North Platte River. The water from the snowmelt that goes into that river and its reservoirs is used extensively downstream through Nebraska for irrigation and other uses.

A large variety of federal, state and local agencies as well as interests in agricultural, power and recreation monitor very closely the amount of snow in the mountains as early as December and January. The amount of water available later in the year is important and many decisions are made by users especially when the snowpack is below average and less water will be available.

As of mid December, the snowpack in the Snowy and Sierra Madre Ranges was above normal. Between 110% and 130% of the normal snowpack was observed in the Lower Snake River Basin, the Upper North Platte Basin and the Lower North Platte Basin. The snowpack in the mountains can be viewed on the internet from http://www.wrds.uwyo.edu/wrds/nrcs/snowmap/snowmap.html

Just for Fun Answers:

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Advisory
Blizzard
Dense Fog
Drift
Drizzle
Flurries
Freezing
Frost
Ice Storm
Sleet
Visibility
Warning
Watch
Whiteout
Wind chill